PartB

2. (40 points) Write the following queries (in SQL only), based on the database schema

(a) Give the manufacturer and speed of laptops with a hard disk of at least thirty gigabytes

```
SELECT DISTINCT
    Product.maker, Laptop.speed
FROM
    Product,
    Laptop
WHERE
    Product.model = Laptop.model
        AND laptop.hd >= 30;
```

maker	speed
E	2.00
E	1.73
E	1.80
A	2.00
A	2.16
B	1.83
F	1.60
G	2.00

(b). Find the model number and price of all products (of any type) made by manufacturer B

```
Select *
from
    (select model, price
    from product natural join pc
    where maker = "B")T1
Union
    (select model, price
    from product natural join laptop
    where maker = "B")
Union
    (select model, price
    from product natural join printer
    where maker = "B")
```

Output:

model	price
1004	649
1005	630
1006	1049
2007	1429

(c) Find those manufacturers that sell Laptops, but not PC's.

```
SELECT DISTINCT
    maker
FROM
    Product
WHERE
    type = 'laptop'
        AND maker NOT IN (SELECT
            maker
        FROM
            Product
        WHERE
            type = 'pc');
```

maker
F
G

(d). Find those hard-disk sizes that occur in two or more PC’s

```
select A.hd
from pc A
inner join pc B
on A.hd = B.hd
and A.model < B.model
```

hd
250
250
250
250
250
250
250
250
250
80

250
250
250
250
250
250
160

(e) Find those pairs of PC models that have both the same speed and RAM. A pair should be listed only once; e.g. list (i,j) but not (j,i)

```
SELECT
    PC1.model, PC2.model
FROM
    PC PC1,
    PC PC2
WHERE
    PC1.model < PC2.model
        AND PC1.speed = PC2.speed
        AND PC1.ram = PC2.ram;
```

model	model
1004	1012

(f) Find those manufacturers of at least two different computers (PC's or laptops) with speeds of at least 3.0

```
select T3.maker
from
	(
	select *
	from(
			(select model, speed, maker
			from product
			natural join pc
			where speed >= 3.0)
			) T1
		union
			(select model, speed, maker
			from product
			natural join laptop
			where speed >= 3.0)
		)T2
inner join
	(
	select *
	from(
			(select model, speed, maker
			from product
			natural join pc
			where speed >= 3.0)
			) T1
		union
			(select model, speed, maker
			from product
			natural join laptop
			where speed >= 3.0)
		)T3
on T2.maker = T3.maker
and T2.model < T3.model
```

Output:

maker
B

(g) Find the makers of PC's with a speed of at least 3.0

```
SELECT DISTINCT
	maker
FROM
	Product,
```

```
        PC
WHERE
        Product.model = PC.model
            AND PC.speed >= 3.0;
```

maker
B
E

(h) Find the printers with the highest price

```
Select t1.model
from
        (select p1.*
        from printer p1 inner join printer p2
        on p1.price > p2.price)t1
left join
        (select q1.*
        from printer q1 inner join printer q2
        on q1.price < q2.price)t2
on t1.price = t2.price
where t2.price is null
```

Output:

model
3003
3003
3003
3003
3003
3003

(i) Find the laptops whose speed is slower than that of any PC

```
SELECT
        Laptop.model
FROM
        Laptop,
        (SELECT DISTINCT
            MIN(speed) AS minspeed
        FROM
            PC) AS t1
```

```
WHERE
    Laptop.speed < t1.minspeed;
```

model

(j). Find the model number of the item (PC, laptop or printer) with the highest price.

```
Select M1.model
from
    (Select P1.model, P1.price
    from(
        select *
        from(Select model, price
            from product
            natural join pc)t1
        union
            (select model, price
            from product
            natural join laptop)
        union
            (select model, price
            from product
            natural join printer)
        )P1
    inner join
        (
        select *
        from
            (Select model, price
            from product
            natural join pc)t2
        union
            (select model, price
            from product
            natural join laptop)
        union
            (select model, price
            from product
            natural join printer)
        )P2
    on P1.price > P2.price
    )M1

left join
(
```

```
Select *
from(
    Select P3.model, P3.price
    from
        (
        select *
        from
            (Select model, price
            from product
            natural join pc)t3
        union
            (select model, price
            from product
            natural join laptop)
        union
            (select model, price
            from product
            natural join printer)
        )P3
    inner join
        (
        select *
        from
            (Select model, price
            from product
            natural join pc)t4
        union
            (select model, price
            from product
            natural join laptop)
        union
            (select model, price
            from product
            natural join printer)
            )P4
    on P3.price < P4.price
    )M2
)MM2
on M1.price = MM2.price
where MM2.price is null
```

model
2001

(k) Find the maker of the color printer with the lowest price

```
SELECT
    Product.maker
FROM
    Product,
    (SELECT
        model, MIN(price) AS min_price
    FROM
        Printer
    WHERE
        color = 1) AS t1
WHERE
    Product.model = t1.model
```

maker
E

(l). Find the maker(s) of the PC(s) with the fastest processor among all those PC's that have the smallest amount of RAM.

```
Select
    PC.maker
From
    PC,
    Product
Where PC.model = Product.model
And PC.ram <= (select Min(ram) from PC)
And PC.speed >= (select Max(speed) from PC)
```

maker
B
B
B
B
B
B
B
B
B
B
B
B

(m) Write a query that will produce information about all products (PC, laptops, and printers) including
their manufacturer if available, and whatever information about that product is relevant (i.e., found in the relation for that type of product).

3. A general form of relational-algebra query is: πL(σC (R1 × R2 × . . . × Rn)) Here, L is an arbitrary list of attributes, and C is an arbitrary condition. The list of relations R1, R2, . . . , Rn may include the same relation repeated several times, in which case appropriate renaming may be assumed applied to the R0 i s. Show how to express any query of this form in SQL.

```
SELECT DISTINCT
    L
FROM
    R1 t2,
    R1 t2,
    .
    .
    .
    Rn tn
WHERE
    C
```